

United States Department of Agriculture Natural Resources Conservation Service

Ecological Site Description

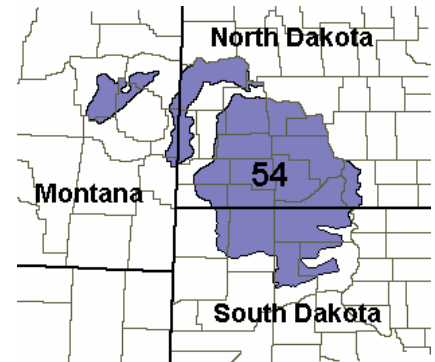
Site Name: Claypan

Site Type: Rangeland

Site ID: R054XY021ND

Major Land Resource Area: 54 – Rolling Soft Shale Plain

For more information on MLRA's refer to the following web site:
http://www.essc.psu.edu/soil_info/soil_lrr/



Physiographic Features

This site occurs on gently undulating to rolling sedimentary uplands.

Landform: alluvial fan, alluvial flat, hill and knoll **Aspect:** NA

	<u>Minimum</u>	<u>Maximum</u>
Elevation (feet):	1600	3600
Slope (percent):	0	25
Water Table Depth (inches):	48	>72
Flooding:		
Frequency:	None	None
Duration:	None	None
Ponding:		
Depth (inches):	None	None
Frequency:	None	None
Duration:	None	None
Runoff Class:	Medium	Very high

Climatic Features

MLRA 54 is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are characteristic. The climate is the result of this MLRA's location in the geographic center of North America. There are few natural barriers on the northern Great Plains. The air masses move unobstructed across the plains and account for rapid changes in temperature.

Annual precipitation ranges from 14 to 18 inches per year. The normal average annual temperature is about 42° F. January is the coldest month with average temperatures ranging from about 13° F (Beach, ND) to about 16° F (Bison, SD). July is the warmest month with temperatures averaging from about 69° F (Beach, ND) to about 72° F (Timber Lake, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 57° F. This large annual range attests to the continental nature of this MLRA's climate. Hourly winds are estimated to average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

Growth of native cool-season plants begins in late March and continues to early to mid July. Native warm-season plants begin growth in mid May and continue to the end of August. Green up of cool-season plants can occur in September and October when adequate soil moisture is present.

	<u>Minimum</u>	<u>Maximum</u>
Frost-free period (days):	119	136
Freeze-free period (days):	139	157
Mean Annual Precipitation (inches):	14	18

Average Monthly Precipitation (inches) and Temperature (°F):

	Precip. Min.	Precip. Max	Temp. Min.	Temp. Max.
January	0.41	0.54	2.2	23.8
February	0.37	0.61	8.7	30.4
March	0.51	1.07	17.1	40.0
April	1.13	1.88	28.9	56.8
May	1.98	2.83	40.5	69.3
June	2.83	3.29	49.8	78.3
July	2.05	2.25	54.6	85.2
August	1.49	2.07	53.0	84.3
September	1.29	1.45	42.0	73.4
October	0.89	1.35	31.6	60.4
November	0.48	0.61	19.0	41.5
December	0.42	0.55	8.1	29.0

Climate Stations		Period	
Station ID	Location or Name	From	To
ND0590	Beach	1949	1999
MT7560	Sidney	1949	1999
SD8307	Timber Lake	1948	1999
ND2183	Dickinson FAA AP	1948	1999

For local climate stations that may be more representative, refer to <http://www.wcc.nrcs.usda.gov>.

Influencing Water Features

No significant water features influence this site.

Representative Soil Features

The common features of soils in this site are the silty clay to clay textured subsoils and slopes of 0 to 25 percent. The soils in this site are moderately well to well drained and formed in soft siltstone, shales and alluvium. The fine sandy loam to clay loam surface layer is 4 to 15 inches thick. The extremely hard clayey Btn horizon has round-topped or "bun shaped" columnar structure. These Btn horizons are high in sodium. The soils have moderate to slow infiltration rate and very slow saturated hydraulic conductivity. This site should show slight to no evidence of rills, wind scoured areas or pedestalled plants. Water flow paths are broken, irregular in appearance or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 9 percent. Loss of the soil surface layer can result in a shift in species composition and/or production.

Major soil series correlated to this ecological site can be found in Section II of the Natural Resources Conservation Service Field Office Technical Guide or the following web sites:

North Dakota <http://www.nd.nrcs.usda.gov/>

South Dakota <http://www.sd.nrcs.usda.gov/>

Montana <http://www.mt.nrcs.usda.gov/>

Parent Material Kind: alluvium and residuum

Parent Material Origin: shale, siltstone

Surface Texture: loam, silt loam, clay loam

Surface Texture Modifier: none

Subsurface Texture Group: clayey

Surface Fragments $\leq 3''$ (% Cover): 0

Surface Fragments $> 3''$ (%Cover): 0

Subsurface Fragments $\leq 3''$ (% Volume): 0-20

Subsurface Fragments $> 3''$ (% Volume): 0-10

	<u>Minimum</u>	<u>Maximum</u>
Drainage Class:	moderately well	well
Permeability Class:	very slow	slow
Depth to first restrictive layer (inches):	8	24
Electrical Conductivity (mmhos/cm)*:	8	16
Sodium Absorption Ratio*:	15	25
Soil Reaction (1:1 Water)*:	5.1	9
Soil Reaction (0.1M CaCl₂)*:	NA	NA
Available Water Capacity (inches)*:	2	5
Calcium Carbonate Equivalent (percent)*:	0	10

* - These attributes represent from 0-40 inches or to the first restrictive layer.

Plant Communities

Ecological Dynamics of the Site:

The site developed under Northern Great Plains climatic conditions, and included natural influence of large herbivores and occasional fire. Changes will occur in the plant communities due to management actions and/or climatic conditions. Due to the nature of the soils, the site is considered quite fragile. Under continued adverse impacts, a rapid decline in vegetative vigor and composition will occur. Under favorable vegetative management treatments the site can slowly return to the Historic Climax Plant Community (HCPC).

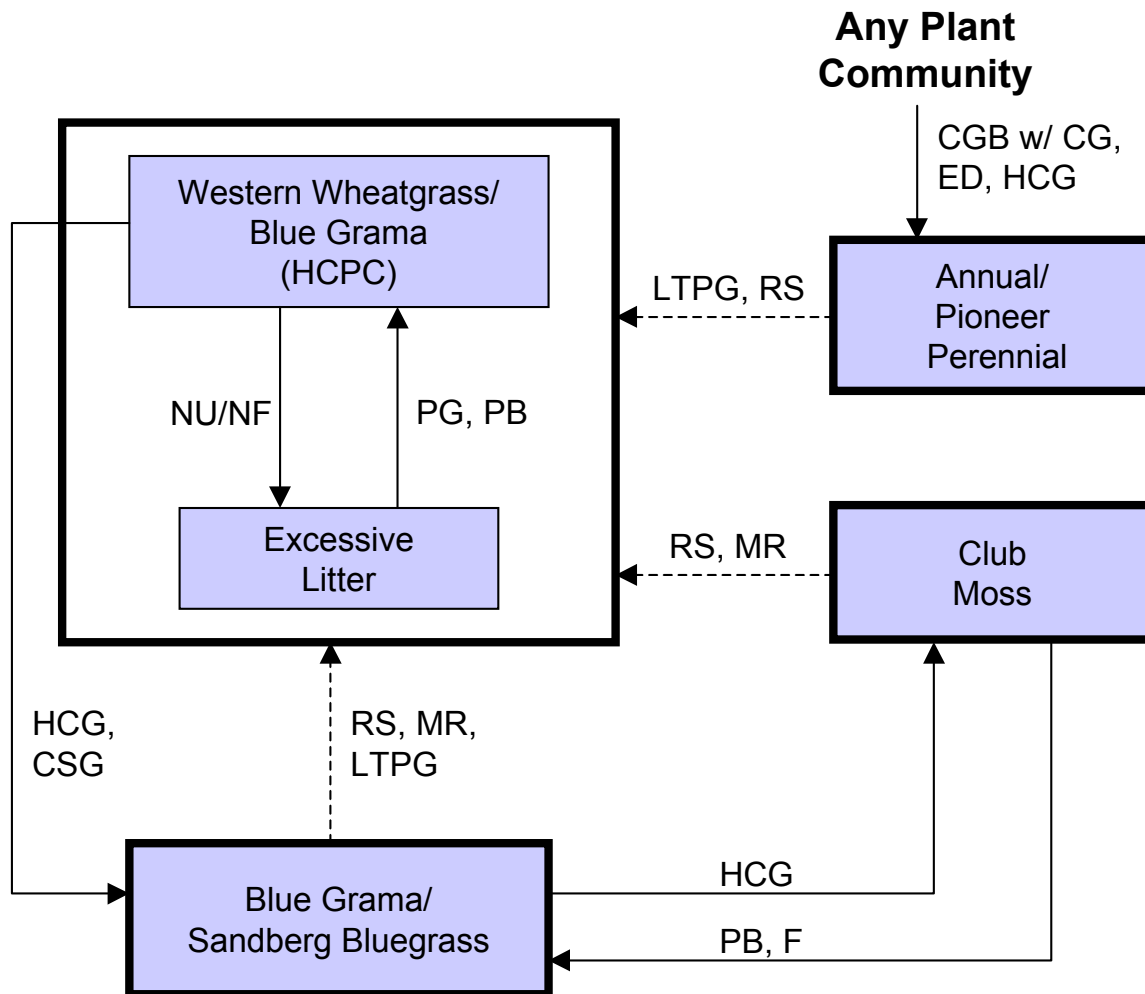
The plant community upon which interpretations are primarily based is the HCPC. The HCPC has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been considered.

Heavy continuous grazing and/or continuous seasonal (spring) grazing, without adequate recovery periods following each grazing occurrence causes this site to depart from the HCPC. Blue grama and buffalograss will begin to increase. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass will decrease in frequency and production. In time, heavy continuous grazing will likely cause blue grama and buffalograss to dominate and pioneer perennials, annuals, and club moss (in its range) to increase. This plant community is relatively stable and the competitive advantage prevents other species from establishing. This plant community is less productive than the HCPC. Runoff increases and infiltration will decrease. Soil erosion will be minimal.

Extended periods of non-use and/or lack of fire will result in a plant community having high litter levels, which favors an increase in Kentucky bluegrass and/or smooth brome grass.

The following diagram illustrates the common plant communities and vegetation states commonly occurring on the site and the transition pathways between communities and states. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

Plant Communities and Transitional Pathways



CGB w/ CG - cropped go-back with continuous grazing; **CSG** - continuous seasonal grazing; **ED** - excessive defoliation; **F** - fertilization with prescribed grazing; **HCPC** - Historic Climax Plant Community; **HCG** - heavy continuous grazing; **LTPG** - long-term prescribed grazing; **MR** - mechanical renovation with prescribed grazing; **NU/NF** - extended period of non-use & no fire; **PB** - prescribed burning, followed by prescribed grazing; **PG** - prescribed grazing; **RS** - range seeding with prescribed grazing

Plant Community Composition and Group Annual Production

		Western Wheatgrass/ Blue Grama (HCPC)		
COMMON/GROUP NAME	SYMBOL	Group	lbs./acre	% Comp
GRASSES & GRASS-LIKES			1200 - 1350	80 - 90
		1	300 - 450	20 - 30
western wheatgrass	PASM	1	300 - 450	20 - 30
thickspike wheatgrass	ELLAL	1	0 - 150	0 - 10
		2	150 - 225	10 - 15
blue grama	BOGR2	2	150 - 225	10 - 15
buffalograss	BUDA	2	15 - 75	1 - 5
		3	150 - 300	10 - 20
needleandthread	HECOC8	3	75 - 225	5 - 15
green needlegrass	NAVI4	3	75 - 150	5 - 10
Sandberg bluegrass	POSE	3	30 - 75	2 - 5
OTHER NATIVE PERENNIALS		4	75 - 150	5 - 10
plains reedgrass	CAMO	4	0 - 75	0 - 5
prairie junegrass	KOMA	4	30 - 75	2 - 5
inland saltgrass	DISP	4	15 - 45	1 - 3
prairie sandreed	CALO	4	15 - 45	1 - 3
dropseed	SPORO	4	0 - 15	0 - 1
other perennial grasses	2GP	4	15 - 75	1 - 5
GRASS-LIKES		5	30 - 105	2 - 7
needleleaf sedge	CADU6	5	15 - 75	1 - 5
threadleaf sedge	CAFI	5	15 - 30	1 - 2
other grass-likes	2GL	5	0 - 45	0 - 3
FORBS		6	75 - 180	5 - 12
blanketflower	GAAR	6	15 - 30	1 - 2
cudweed sagewort	ARLU	6	15 - 30	1 - 2
heath aster	SYER	6	15 - 30	1 - 2
Lambert crazyweed	OXLA3	6	15 - 30	1 - 2
Missouri goldenrod	SOMI2	6	15 - 15	1 - 1
Nuttall's violet	VINU2	6	15 - 15	1 - 1
prairie coneflower	RACO3	6	15 - 30	1 - 2
prairie smoke	GETR	6	0 - 15	0 - 1
rose pussytoes	ANRO2	6	0 - 15	0 - 1
rush skeletonweed	LYJU	6	15 - 15	1 - 1
scarlet globemallow	SPCO	6	15 - 15	1 - 1
silverleaf scurfpea	PEAR6	6	15 - 30	1 - 2
sticky cinquefoil	POGL9	6	15 - 15	1 - 1
wavyleaf thistle	CIUN	6	15 - 15	1 - 1
western yarrow	ACMI2	6	15 - 30	1 - 2
wild onion	ALLIU	6	15 - 15	1 - 1
wild parsley	MUDI	6	15 - 15	1 - 1
woolly Indianwheat	PLPA2	6	15 - 15	1 - 1
native annual/biennial forbs	2FORB	6	0 - 30	0 - 2
native perennial forbs	2FP	6	0 - 30	0 - 2
SHRUBS		7	15 - 75	1 - 5
big sagebrush	ARTR2	7	0 - 30	0 - 2
brittle cactus	OPFR	7	0 - 15	0 - 1
broom snakeweed	GUSA2	7	15 - 30	1 - 2
fringed sagewort	ARFR4	7	15 - 30	1 - 2
Nuttall's saltbush	ATNU2	7	15 - 30	1 - 2
plains pricklypear	OPPO	7	0 - 15	0 - 1
purple pincushion	ESVIV	7	15 - 15	1 - 1
rubber rabbitbrush	ERNA10	7	0 - 30	0 - 2
silver sagebrush	ARCA13	7	0 - 30	0 - 2
winterfat	KRLA2	7	15 - 30	1 - 2
other shrubs	2SHRUB	7	0 - 30	0 - 2
CRYPTOGAMS		8	0 - 15	0 - 1
clubmoss	SEDE2	8	0 - 15	0 - 1
Annual Production lbs./acre		LOW RV HIGH		
GRASSES & GRASS-LIKES		920 - 1320 -1715		
FORBS		70 - 128 -185		
SHRUBS		10 - 45 -80		
CRYPTOGAMS		0 - 8 -20		
TOTAL		1000 - 1500 -2000		

This list of plants and their relative proportions are based on near normal years. Fluctuations in species composition and relative production may change from year to year dependent upon precipitation or other climatic factors. RV = Representative Value.

Plant Community Composition and Group Annual Production

		Western Wheatgrass/ Blue Grama (HCPC)			Blue Grama/ Sandberg Bluegrass			Excessive Litter			Club Moss		
COMMON/GROUP NAME	SYMBOL	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp
GRASSES & GRASS-LIKES		1	1200 - 1350	80 - 90		375 - 425	75 - 85		975 - 1105	75 - 85		260 - 300	65 - 75
		1	300 - 450	20 - 30	1	25 - 35	5 - 7	1	52 - 130	4 - 10	1	20 - 32	5 - 8
western wheatgrass	PASM	1	300 - 450	20 - 30	1	25 - 35	5 - 7	1	65 - 130	5 - 10	1	12 - 32	3 - 8
thickspike wheatgrass	ELLAL	1	0 - 150	0 - 10	1	0 - 25	0 - 5	1	0 - 52	0 - 4	1	0 - 20	0 - 5
		2	150 - 225	10 - 15	2	175 - 200	35 - 40	2	13 - 65	1 - 5	2	120 - 140	30 - 35
blue grama	BOGR2	2	150 - 225	10 - 15	2	175 - 200	35 - 40	2	13 - 52	1 - 4	2	80 - 120	20 - 30
buffalograss	BUDA	2	15 - 75	1 - 5	2	25 - 50	5 - 10	2	13 - 26	1 - 2	2	20 - 60	5 - 15
		3	150 - 300	10 - 20	3	60 - 100	12 - 20	3	39 - 130	3 - 10	3	40 - 56	10 - 14
needleandthread	HECOC8	3	75 - 225	5 - 15	3	10 - 50	2 - 10	3	13 - 65	1 - 5	3	8 - 20	2 - 5
green needlegrass	NAV14	3	75 - 150	5 - 10	3	0 - 5	0 - 1	3	13 - 65	1 - 5	3	0 - 4	0 - 1
Sandberg bluegrass	POSE	3	30 - 75	2 - 5	3	50 - 90	10 - 18	3	13 - 65	1 - 5	3	32 - 56	8 - 14
OTHER NATIVE PERENNIALS		4	75 - 150	5 - 10	4	10 - 30	2 - 6	4	26 - 65	2 - 5	4	20 - 40	5 - 10
plains reedgrass	CAMO	4	0 - 75	0 - 5	4	0 - 5	0 - 1	4	0 - 13	0 - 1	4	0 - 4	0 - 1
prairie junegrass	KOMA	4	30 - 75	2 - 5	4	5 - 10	1 - 2	4	13 - 26	1 - 2	4	4 - 8	1 - 2
inland saltgrass	DISP	4	15 - 45	1 - 3	4	10 - 30	2 - 6	4	0 - 13	0 - 1	4	8 - 32	2 - 8
prairie sandreed	CALO	4	15 - 45	1 - 3	4	0 - 5	0 - 1	4	0 - 13	0 - 1	4	0 - 4	0 - 1
dropseed	SPORO	4	0 - 15	0 - 1	4	5 - 20	1 - 4	4	0 - 13	0 - 1	4	4 - 20	1 - 5
other perennial grasses	2GP	4	15 - 75	1 - 5	4	0 - 10	0 - 2	4	0 - 13	0 - 1	4	0 - 8	0 - 2
other annual grasses	2GA				4	0 - 5	0 - 1	4	0 - 13	0 - 1	4	0 - 12	0 - 3
GRASS-LIKES		5	30 - 105	2 - 7	5	10 - 25	2 - 5	5	0 - 13	0 - 1	5	4 - 12	1 - 3
needleleaf sedge	CADU6	5	15 - 75	1 - 5	5	5 - 25	1 - 5	5	0 - 13	0 - 1	5	4 - 12	1 - 3
threadleaf sedge	CAFI	5	15 - 30	1 - 2	5	0 - 5	0 - 1	5	0 - 13	0 - 1	5	0 - 4	0 - 1
other grass-likes	2GL	5	0 - 45	0 - 3	5	0 - 15	0 - 3	5	0 - 13	0 - 1	5	0 - 12	0 - 3
NON-NATIVE GRASSES		6			6			6	455 - 585	35 - 45	6	0 - 16	0 - 4
Kentucky bluegrass	POPR							6	260 - 585	20 - 45			
smooth bromegrass	BRIN2							6	0 - 585	0 - 45			
crested wheatgrass	AGCR							6	0 - 585	0 - 45	6	0 - 16	0 - 4
cheatgrass	BRTE							6	0 - 13	0 - 1	6	0 - 8	0 - 2
FORBS		7	75 - 180	5 - 12	7	25 - 60	5 - 12	7	13 - 169	1 - 13	7	20 - 48	5 - 12
blanketflower	GAAR	7	15 - 30	1 - 2	7	0 - 10	0 - 2				7	0 - 8	0 - 2
cudweed sagewort	ARLU	7	15 - 30	1 - 2	7	15 - 50	3 - 10	7	0 - 26	0 - 2	7	8 - 40	2 - 10
curlycup gumweed	GRSQ				7	0 - 25	0 - 5				7	0 - 20	0 - 5
heath aster	SYER	7	15 - 30	1 - 2	7	15 - 50	3 - 10				7	8 - 40	2 - 10
Lambert crazyweed	OXLA3	7	15 - 30	1 - 2	7	10 - 25	2 - 5	7	0 - 13	0 - 1	7	4 - 20	1 - 5
Missouri goldenrod	SOMI2	7	15 - 15	1 - 1	7	0 - 5	0 - 1	7	0 - 13	0 - 1	7	0 - 4	0 - 1
Nuttall's violet	VINU2	7	15 - 15	1 - 1	7	0 - 10	0 - 2	7	0 - 13	0 - 1	7	0 - 8	0 - 2
prairie coneflower	RAC03	7	15 - 30	1 - 2	7	10 - 25	2 - 5	7	0 - 13	0 - 1	7	8 - 40	2 - 10
prairie smoke	GETR	7	0 - 15	0 - 1	7	0 - 5	0 - 1				7	0 - 4	0 - 1
rose pussetoes	ANRO2	7	0 - 15	0 - 1	7	5 - 10	1 - 2				7	4 - 8	1 - 2
rush skeletonweed	LYJU	7	15 - 15	1 - 1	7	5 - 10	1 - 2	7	0 - 13	0 - 1	7	4 - 8	1 - 2
scarlet globemallow	SPCO	7	15 - 15	1 - 1	7	5 - 15	1 - 3	7	0 - 13	0 - 1	7	4 - 12	1 - 3
silverleaf scurp	PEAR6	7	15 - 30	1 - 2	7	15 - 50	3 - 10	7	0 - 13	0 - 1	7	8 - 40	2 - 10
sticky cinquefoil	POGL9	7	15 - 15	1 - 1	7	0 - 5	0 - 1				7	0 - 4	0 - 1
wavyleaf thistle	CIUN	7	0 - 15	0 - 1	7	10 - 25	2 - 5	7	0 - 26	0 - 2	7	8 - 20	2 - 5
western salsify	TRDU				7	5 - 10	1 - 2	7	0 - 13	0 - 1	7	4 - 8	1 - 2
western yarrow	ACMI2	7	15 - 30	1 - 2	7	10 - 25	2 - 5	7	0 - 26	0 - 2	7	8 - 20	2 - 5
wild onion	ALLIU	7	15 - 15	1 - 1	7	5 - 10	1 - 2				7	4 - 8	1 - 2
wild parsley	MUDI	7	15 - 15	1 - 1	7	0 - 10	0 - 2	7	0 - 13	0 - 1	7	0 - 8	0 - 2
woolly Indianwheat	PLPA2	7	15 - 15	1 - 1	7	5 - 10	1 - 2				7	4 - 8	1 - 2
native annual/biennial forbs	2FORB	7	0 - 30	0 - 2	7	10 - 25	2 - 5	7	0 - 26	0 - 2	7	8 - 48	2 - 12
native perennial forbs	2FP	7	0 - 30	0 - 2	7	0 - 10	0 - 2	7	0 - 26	0 - 2	7	0 - 8	0 - 2
non-native forbs	2FORB				7	0 - 50	0 - 10	7	0 - 169	0 - 13	7	0 - 48	0 - 12
SHRUBS		8	15 - 75	1 - 5	8	5 - 25	1 - 5	8	65 - 130	5 - 10	8	4 - 24	1 - 6
big sagebrush	ARTR2	8	0 - 30	0 - 2	8	0 - 20	0 - 4	8	0 - 130	0 - 10	8	0 - 16	0 - 4
brittle cactus	OPFR	8	0 - 15	0 - 1	8	5 - 15	1 - 3	8	0 - 13	0 - 1	8	4 - 16	1 - 4
broom snakeweed	GUSA2	8	15 - 15	1 - 1	8	5 - 15	1 - 3	8	0 - 13	0 - 1	8	4 - 20	1 - 5
fringed sagewort	ARFR4	8	15 - 30	1 - 2	8	10 - 25	2 - 5	8	0 - 26	0 - 2	8	8 - 24	2 - 6
Nuttall's saltbush	ATNU2	8	15 - 30	1 - 2	8	0 - 5	0 - 1	8	0 - 26	0 - 2	8	0 - 4	0 - 1
plains pricklypear	OPPO	8	0 - 15	0 - 1	8	5 - 15	1 - 3	8	0 - 13	0 - 1	8	4 - 16	1 - 4
purple pincushion	ESVIV	8	15 - 15	1 - 1	8	0 - 5	0 - 1	8	0 - 13	0 - 1	8	0 - 4	0 - 1
rubber rabbitbrush	ERNA10	8	0 - 30	0 - 2	8	0 - 15	0 - 3	8	0 - 39	0 - 3	8	0 - 12	0 - 3
silver sagebrush	ARCA13	8	0 - 30	0 - 2	8	5 - 20	1 - 4	8	0 - 130	0 - 10	8	4 - 16	1 - 4
winterfat	KRLA2	8	15 - 30	1 - 2	8	0 - 5	0 - 1	8	0 - 26	0 - 2	8	0 - 4	0 - 1
other shrubs	2SHRUB	8	0 - 30	0 - 2				8	0 - 26	0 - 2			
CRYPTOGAMS		9	0 - 15	0 - 1	9	5 - 25	1 - 5	9	0 - 13	0 - 1	9	20 - 32	5 - 8
clubmoss	SEDE2	9	0 - 15	0 - 1	9	5 - 25	1 - 5	9	0 - 13	0 - 1	9	20 - 32	5 - 8
Annual Production lbs./acre			LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		
GRASSES & GRASS-LIKES			920 - 1320 - 1715		230 - 428 - 575		830 - 1105 - 1480		220 - 326 - 490				
FORBS			70 - 128 - 185		20 - 43 - 65		10 - 91 - 170		15 - 34 - 50				
SHRUBS			10 - 45 - 80		0 - 15 - 30		60 - 98 - 135		0 - 14 - 25				
CRYPTOGAMS			0 - 8 - 20		0 - 15 - 30		0 - 7 - 15		15 - 26 - 35				
TOTAL			1000 - 1500 - 2000		250 - 500 - 700		900 - 1300 - 1800		250 - 400 - 600				

This list of plants and their relative proportions are based on near normal years. Fluctuations in species composition and relative production may change from year to year dependent upon precipitation or other climatic factors. RV = Representative value.

Plant Community and Vegetation State Narratives

Following are the narratives for each of the described plant communities. These plant communities may not represent every possibility, but they are the most prevalent and repeatable plant communities. The plant composition tables shown above have been developed from the best available knowledge at the time of this revision. As more data are collected, some of these plant communities may be revised or removed, and new ones may be added. None of these plant communities should necessarily be thought of as "Desired Plant Communities". According to the USDA NRCS National Range and Pasture Handbook, Desired Plant Communities (DPC's) will be determined by the decision-makers and will meet minimum quality criteria established by the NRCS. The main purpose for including any description of a plant community here is to capture the current knowledge and experience at the time of this revision.

Western Wheatgrass/Blue Grama Plant Community

This is the interpretive plant community and is considered to be the Historic Climax Plant Community (HCPC). This community evolved with grazing by large herbivores and occasional prairie fire. It is well suited for grazing by domestic livestock and can be found on areas that are properly managed with prescribed grazing that allows for proper utilization, changes in season of use and adequate recovery periods following each grazing event.

The potential vegetation is about 82% grasses or grass-like plants, 12% forbs, 5% shrubs and 1% cryptograms. Cool-season grasses dominate the site, but warm-season short grasses are also prevalent. Western wheatgrass is the dominant grass. Other grasses and grass-like plants occurring on the site include blue grama, needleandthread, buffalograss, green needlegrass, Sandberg bluegrass, inland saltgrass and sedges. Significant forbs include silverleaf scurfpea, cudweed sagewort and heath aster. Silver and/or big sagebrush are the principal shrubs and occur in a randomly scattered mosaic. Other shrubs include, winterfat, fringed sagewort and in some locations, Nuttall's saltbush.

This plant community is well adapted to the Northern Great Plains climatic conditions. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Community dynamics, nutrient cycle, water cycle and energy flow are functioning properly. Plant litter is properly distributed with very little movement off-site and natural plant mortality is very low. The diversity in plant species allows for high drought tolerance. Good vegetative cover coupled with moderate available water capacity provides for a favorable soil-water-plant relationship.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during a normal year:

Growth curve number: ND5402

Growth curve name: Missouri Slope, Native Grasslands, Cool/Warm-season Mix.

Growth curve description: Cool-season/warm-season dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	2	6	21	40	20	6	4	1	0	0

Transitional pathways and/or community pathways leading to other plant communities are as follows:

- Non-use and no fire for extended periods of time will convert this plant community to the *Excessive Litter Plant Community*.
- Heavy, continuous grazing will convert the plant community to the *Blue Grama/Sandberg Bluegrass Plant Community*. Further deterioration of this plant community will result in the *Club Moss Plant Community*.

- Continuous seasonal grazing (annual, early spring) will convert the plant community to the *Blue Grama/Sandberg Bluegrass Plant Community*. Further deterioration of this plant community will result in the *Club Moss Plant Community*.
- Excessive defoliation (i.e., areas of heavy animal concentration) will convert the plant community to the *Annual/Pioneer Perennial Plant Community*.
- Go-back land with continuous grazing will convert this plant community to the *Annual/Pioneer Perennial Plant Community* or the *Club Moss Plant Community*.

Blue Grama/Sandberg Bluegrass Plant Community

This plant community can quickly result from heavy continuous grazing and/or annual, early spring seasonal grazing. Annual grazing too early in the spring depletes stored carbohydrates, resulting in weakening and eventual death of the cool season mid-grasses. Short grasses and forbs increase to dominate the plant community and annual production decreases dramatically. Lack of litter and reduced plant vigor result in higher soil temperatures, high evapotranspiration and poor water infiltration rates, which gives blue grama a competitive advantage over cool season mid-grasses. This plant community can occur throughout the pasture, on spot grazed areas, and around water sources where season-long grazing patterns occur.

Blue grama and Sandberg bluegrass are the prominent species with the balance being a few species of cool-season grasses and warm-season grasses including buffalograss, inland saltgrass, prairie junegrass and needleandthread. Forbs and shrubs such as fringed sagewort, cudweed sagewort, heath aster and western yarrow may also be present. There is usually less than 10% bare ground.

This plant community is relatively stable. The competitive advantage prevents other species from establishing. This plant community is less productive than the HCPC. Runoff increases and infiltration will decrease. Soil erosion will be minimal.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during a normal year:

Growth curve number: ND5404

Growth curve name: Missouri Slope, Warm-season Dominant, Cool-season Subdominant.

Growth curve description: Short warm-season dominant, mid cool-season subdominant & club moss.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	1	5	20	38	25	8	3	0	0	0

Transitional pathways and/or community pathways leading to other plant communities are as follows:

- Long-term prescribed grazing that includes changing season of use and allowing adequate recovery periods to enhance cool season grasses can slowly shift this plant community back towards the *Western Wheatgrass/Blue Grama Plant Community*.
- Mechanical treatments such as chiseling, or range seeding, followed by prescribed grazing are aggressive measures to accelerate a transition leading to a plant community, which closely resembles the *Western Wheatgrass/Blue Grama Plant Community*.
- Heavy, continuous grazing may cause further deterioration resulting in a shift to the *Club Moss Plant Community*.
- Heavy, continuous grazing and/or excessive defoliation may shift this plant community to the *Annual/Pioneer Perennial Plant Community*.
- Go-back land with continuous grazing will convert this plant community to the *Annual/Pioneer Perennial Plant Community* or the *Club Moss Plant Community*.

Excessive Litter Plant Community

This plant community develops after an extended period of 15 years or more of non-use by herbivores and exclusion of fire. This plant community is dispersed throughout the pasture, encircling spot grazed areas, and areas distant from water sources. This is a typical pattern found in properly stocked pastures grazed season-long. Plant litter accumulates in large amounts as this community develops. Litter buildup reduces plant vigor and density, and seedling recruitment declines. Eventually litter levels become abundant enough to crowd out living plants and reduce plant density. Annual and/or biennial forbs, annual grasses, and cryptogams commonly fill these interspaces. Due to a lack of tiller stimulation and sunlight, native bunchgrasses typically develop dead centers and native rhizomatous grasses are limited to small colonies. Heavy litter covers shorter understory species (i.e. short grasses and sedges) restricting their ability to capture adequate sunlight for photosynthesis. Vigor and diversity of native plants are reduced.

Non-native grasses, such as Kentucky bluegrass, crested wheatgrass, and smooth brome grass tend to invade and may dominate this plant community. Other grasses present include western wheatgrass, thickspike wheatgrass, needleandthread and Sandberg bluegrass. The common forbs include sweetclover, cudweed sagewort and western yarrow. Silver sagebrush is the principal shrub.

This plant community is resistant to change without prescribed grazing or fire. The combination of both grazing and fire is most effective in moving this plant community towards the HCPC. Soil erosion is low. Compared to the HCPC, infiltration is reduced to the lower root zone. Runoff is similar to the HCPC. This plant community tends to be moisture loving and usually tends to utilize the spring moisture quickly causing forage base to become dry and not very palatable early in the summer. Once this plant community is reached, time and external resources will be needed to see any immediate recovery in the diversity of the site.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during a normal year:

Growth curve number: ND5406

Growth curve name: Missouri Slope, Introduced Cool-season Grasses.

Growth curve description: Introduced cool-season grasses.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	10	35	35	5	2	8	2	0	0

Transitional pathways and/or community pathways leading to other plant communities are as follows:

- Prescribed grazing or prescribed burning followed by prescribed grazing, will move this plant community toward the *Western Wheatgrass/Blue Grama Plant Community (HCPC)*. This would require long-term management with prescribed grazing and/or prescribed burning under controlled conditions.
- Heavy, continuous grazing and/or excessive defoliation may shift this plant community to the *Annual/Pioneer Perennial Plant Community*.
- Go-back land with continuous grazing will convert this plant community to the *Annual/Pioneer Perennial Plant Community* or the *Club Moss Plant Community*.

Club Moss Plant Community

This plant community typically occurs in the western portion of MLRA 54. A dense sod of club moss dominates this plant community. Club moss occupies bare soil areas within deteriorated or disturbed higher successional plant communities due to long-term repeated disturbances. Club moss cover is often 25% or greater. Club moss creates a more arid microclimate, resulting in extreme competition for available moisture. Vigor and production of other species is reduced dramatically.

Grasses include western wheatgrass, thickspike wheatgrass, Sandberg bluegrass, needleandthread, blue grama, buffalograss and inland saltgrass. Forbs commonly found in this plant community include cudweed sagewort, heath aster, silverleaf scurfpea and prairie coneflower. When compared to the HCPC, blue grama and club moss have increased, while western wheatgrass and green needlegrass have decreased.

This plant community is very resistant to change. The thick sod and competitive advantage of both the clubmoss and the blue grama prevents other species from expanding and establishing. This plant community is far less productive than the HCPC. Initial runoff rates are low but then increase as clubmoss becomes saturated. Once clubmoss has been saturated then runoff increases and infiltration decreases as compared HCPC. Soil erosion will be minimal due to the sod forming habit of both the clubmoss and blue grama.

The following growth curve represents monthly percentages of total annual growth of the dominant species during a normal year:

Growth curve number: ND5404

Growth curve name: Missouri Slope, Warm-season Dominant, Cool-season Subdominant.

Growth curve description: Short warm-season dominant, mid cool-season subdominant & club moss.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	1	5	20	38	25	8	3	0	0	0

Transitional pathways and/or community pathways leading to other plant communities are as follows:

- Fertilization combined with prescribed grazing may eventually shift this plant community to the *Blue Grama/Sandberg Bluegrass Plant Community*.
- Prescribed burning followed by prescribed grazing may eventually shift this plant community to the *Blue Grama/Sandberg Bluegrass Plant Community*.
- Mechanical treatments such as chiseling, or range seeding, followed by prescribed grazing are aggressive measures to accelerate a transition leading to a plant community resembling the *Western Wheatgrass/Blue Grama Plant Community*.
- Excessive defoliation (i.e., areas of heavy animal concentration) will convert the plant community to the *Annual/Pioneer Perennial Plant Community*.
- Go-back land with continuous grazing will convert this plant community to the *Annual/Pioneer Perennial Plant Community*.

Annual/Pioneer Perennial Plant Community

This plant community develops under severe disturbance and/or excessive defoliation. This can result from heavy livestock or wildlife concentration, and cropping abandonment (go-back land). The dominant vegetation includes pioneer annual grasses, forbs, invaders, and early successional biennial and perennial species. Grasses may include sixweeks fescue, smooth brome grass, crested wheatgrass, annual brome grass, needleandthread, prairie junegrass and western wheatgrass. The dominant forbs include curlycup gumweed, maretail, salsify, kochia, field bindweed, thistles, western ragweed, pussytoes, prostrate verbena and other early successional species. Shrubs that may be present include fringed sagewort and broom snakeweed. Plant species from adjacent ecological sites may become minor components of this plant community. The community also is susceptible to invasion of non-native annual and perennial forbs due to severe soil disturbances and relatively high percent of bare ground. Compared to the HCPC, western wheatgrass, thickspike wheatgrass, green needlegrass, needleandthread, and blue grama have decreased.

This plant community is resistant to change, as long as soil disturbance or severe vegetation defoliation persists, thus holding back secondary plant succession. Soil erosion is potentially high. Reduced surface cover, low plant density, low plant vigor, loss of root biomass, and soil compaction, all contribute to decreased water infiltration, increased runoff, and accelerated erosion rates.

Significant economic inputs, management and time would be required to move this plant community toward a higher successional stage and a more productive plant community. Secondary succession is highly variable, depending upon availability and diversity of a viable seed bank of higher successional species within the existing plant community and neighboring plant communities. This plant community can be renovated to improve the production capability, but management changes would be needed to maintain the new plant community. The total annual production ranges from 200 to 1000 lbs./ac. (air-dry weight) depending upon growing conditions.

Transitional pathways and/or community pathways leading to other plant communities are as follows:

- Range seeding with deferment and prescribed grazing can convert this to a plant community resembling the *Western Wheatgrass/Blue Grama Plant Community*.
- Under long-term prescribed grazing and/or removal of disturbance, including adequate rest periods, this plant community will move through the successional stages, and may eventually lead to the *Western Wheatgrass/Blue Grama Plant Community (HCPC)*. Depending on the slope, aspect, and size, and if adequate perennial plants exist, this change can occur more rapidly. This process will likely take a long period of time (50+ years).

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

-- Under Development --

Western Wheatgrass/Blue Grama Plant Community:

Blue Grama/Sandberg Bluegrass Plant Community:

Excessive Litter Plant Community:

Club Moss Plant Community:

Annual/Pioneer Perennial Plant Community:

Animal Preferences (Quarterly – 1,2,3,4[†])

Common Name	Cattle	Sheep	Horses	Deer	Antelope	Bison	Elk
Grasses & Grass-like							
blue grama	U D P U	D P P D	U D P U	D P P D	D P P D	U D P U	U D P U
buffalograss	U U D U	N U D U	U U D U	N U D U	N U D U	U U D U	U U D U
cheatgrass	U D U U	N P U N	U D U U	N P U N	N P U N	U D U U	U D U U
crested wheatgrass	U P U D	U P N N	U P U D	U P N N	U P N N	U P U D	U P U D
dropseed	N U N N	N U N N	N U N N	N U N N	N U N N	N U N N	N U N N
green needlegrass	U P U D	N P N P	U P U D	N P N P	N P N P	U P U D	U P U D
inland saltgrass	N U U N	N N N N	N U U N	N N N N	N N N N	N U U N	N U U N
Kentucky bluegrass	U D U U	U P N D	U D U U	U P N D	U P N D	U D U U	U D U U
needleandthread	U D U D	N D N U	U D U D	N D N U	N D N U	U D U D	U D U D
needleleaf sedge	U D U D	U P N D	U D U D	U D U D	U D U D	U D U D	U D U D
plains reedgrass	U D U U	N D N N	U D U U	N D N N	N D N N	U D U U	U D U U
prairie junegrass	U D U D	N D N U	U D U D	N D N U	N D N U	U D U D	U D U D
prairie sandreed	U D D U	U D U U	U D D U	U U D U	U U D U	U D D U	U D D U
Sandberg bluegrass	N U N N	N D N N	N U N N	N D N N	N D N N	N U N N	N U N N
smooth brome	U P U U	U P U U	U P U U	U P U U	U P U U	U P U U	U P U U
thickspike wheatgrass	U D D U	N D N N	U D D U	N D N N	N D N N	U D D U	U D D U
threadleaf sedge	U D U D	U P N D	U D U D	U D U D	U D U D	U D U D	U D U D
western wheatgrass	U P D U	N D N N	U P D U	N D N N	N D N N	U P D U	U P D U
Forbs							
blanketflower	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
cudweed	U U U U	U U D U	U U U U	U U D U	U U D U	U U U U	U U D U
heath aster	U U D U	U U P U	U U D U	U U P U	U U P U	U U D U	U U P U
Lambert crazyweed	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T
Missouri goldenrod	U U D U	N U U N	U U D U	N U U N	N U U N	U U D U	N U U N
Nuttall's violet	N U N N	N U N N	N U N N	N U N N	N U N N	N U N N	N U N N
prairie coneflower	U U D U	U P P U	U U D U	U P P U	U P P U	U U D U	U P P U
prairie smoke	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
rose pussytoes	U U U U	U U U U	U U U U	U U U U	U U U U	U U U U	U U U U
rush skeletonweed	U U U U	N N N N	U U U U	N N N N	N N N N	U U U U	N N N N
scarlet globemallow	U U D U	U D D U	U U D U	U D D U	U D D U	U U D U	U D D U
silverleaf scurfpea	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
sticky cinquefoil	N N N N	N U D N	N N N N	N U D N	N U D N	N N N N	N U D N
wavyleaf thistle	U U U U	N N N N	U U U U	N N N N	N N N N	U U U U	N N N N
western yarrow	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
wild onion	U D U U	U D D U	U D U U	U D D U	U D D U	U D U U	U D D U
wild parsley	U D U U	U D D U	U D U U	U D D U	U D D U	U D U U	U D D U
woolly Indianwheat	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
Shrubs							
big sagebrush	U N U U	D U U D	U N U U	P U D P	P P P P	U N U U	D U U U
brittle cactus	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N
broom snakeweed	N N N N	U U U U	N N N N	U U U U	U U U U	N N N N	U U U U
fringed sagewort	U U U U	U U U U	U U U U	U D D U	U P P D	U U U U	U U U D
Nuttall's saltbush	P D D P	P D D P	P D D P	P D D P	P D D P	P D D P	P D D P
plains pricklypear	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N
purple pincushion	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N
rubber rabbitbrush	N N N N	D U U D	N N N N	D U U D	U D D U	N N N N	D U U U
silver sagebrush	D U U D	D U U D	D U U D	P D D P	P P P P	D U U D	D U U D
winterfat	P P P P	P P P P	P P P P	P P P P	P P P P	P P P P	P P P P

N = not used; **U** = undesirable; **D** = desirable; **P** = preferred; **T** = toxic

[†] Quarters: 1 – Jan., Feb., Mar.; 2 – Apr., May, Jun.; 3 – Jul., Aug., Sep.; 4 – Oct., Nov., Dec.

Animal Community – Grazing Interpretations

The following table lists suggested initial stocking rates for cattle under continuous grazing (year long grazing or growing season long grazing) under normal growing conditions; however, *continuous grazing is not recommended*. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process and may need to be adjusted due to diet preferences of other types or kinds of livestock and/or other factors. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a field visit is recommended, in all cases, to document plant composition and production. More precise carrying capacity estimates should eventually be calculated using the following stocking rate information along with animal preference data, particularly when grazers other than cattle are involved. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

Plant Community	Production (lbs./acre)	Carrying Capacity ¹ (AUM/acre)
Western Wheatgrass/Blue Grama (HCPC)	1500	0.47
Excessive Litter	1300	0.41 ²
Blue Grama/Sandberg Bluegrass	500	0.16
Club Moss	400	0.13
Annual/Pioneer Perennial	-- ³	-- ³

¹ Continuous season-long grazing by cattle under average growing conditions.

² Stocking rates may need to be adjusted due to palatability and/or availability of forage.

³ Highly variable; stocking rate needs to be determined on site.

Hydrology Functions

Water is the principal factor limiting herbage production on this site. The site is dominated by soils in hydrologic group D, with localized areas in hydrologic group C. Infiltration varies from moderate to slow and runoff potential varies from medium to very high depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An exception would be where short grasses form a dense sod and dominate the site. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational Uses

This site provides hunting opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an esthetic value that appeals to many visitors.

Wood Products

No appreciable wood products are present on the site.

Other Products

Seed harvest of native plant species can provide additional income on this site.

Supporting Information

Associated Sites

(054XY020ND) – Clayey

(054XY022ND) – Closed Depression

(054XY031ND) – Loamy

(054XY024ND) – Saline Lowland

(054XY033ND) – Thin Claypan

(054XY038ND) – Thin Loamy

Similar Sites

(054XY020ND) – Clayey (Cy)

[Does not receive additional moisture. Found on dry uplands, upslope from loamy or clayey terraces or loamy overflow sites, down slope from thin loamy, shallow loamy or shallow clayey sites. Similar landscape position as sandy, sands, and loamy sites. Will ribbon greater than 2 inches. Indicator species: dominated by of western wheatgrass and green needlegrass. This site has more production, more green needlegrass, less blue grama, deeper soils, no sodic subsoils layer.]

(054XY022ND) – Closed Depression (Cd)

[Poorly drained clayey soils with sodic subsoils and with noticeable redoximorphic features within depressions. Ponds periodically with no apparent water table. Indicator species: dominated by western wheatgrass with alkaligrass and foxtail barley intermixed, forb indicator is western dock, no shrubs. This site does have similar subsoil but is flooded periodically, a lot more production, more western wheatgrass but no blue grama.]

(054XY031ND) – Loamy (Ly)

[Does not receive additional moisture. Found on dry uplands upslope from loamy terraces or loamy overflow sites, down slope from thin loamy or shallow loam sites; similar landscape position as sandy, sands, clayey sites. Will ribbon greater than 1 inch and up to 2 inches. Indicator species: western wheatgrass, green needlegrass and blue grama, with fringed sagewort and western snowberry or silver sagebrush being the dominant shrubs. This site has more production, more green needlegrass and shrubs, less blue grama, deeper soils, no sodic subsoils layer.]

(054XY027ND) – Sandy Claypan (SyCp)

[Well drained soils on uplands and terraces that don't receive extra moisture with a dense sodic subsoil below 6 inches with salts below 16 inches. Subsoil will ribbon up to 1 inch. Indicator species are western wheatgrass intermixed with areas of prairie sandreed both dominating with an understory of needleandthread and blue grama, heath aster, cudweed sagewort and western yarrow along with fringed sagewort. This site has more production, more prairie sandreed and threadleaf sedge, soil texture is coarser but with similar sodic subsoils layer.]

(054XY028ND) – Shallow Clayey (SwCy)

[Well drained soils more than 10 less than 20 inches to unweathered shales that restricts root penetration. Upslope of clayey site, surface layer will ribbon greater than 2 inches, upslope of clayey ecological sites. Indicator species: western wheatgrass dominates with little bluestem, plains muhly and sideoats grama, gayfeather. This site has more little bluestem, plains muhly, sideoats grama, more green needlegrass, less blue grama and needleandthread, similar production, different restrictive layer.]

(054XY030ND) – Shallow Loamy (SwLy)

[Well drained soils > 10 and ≤ 20 inches to sedimentary bedrock restricting root penetration. Surface layer ribbons > 1 but < 2 inches. Upslope from thin loamy or loamy sites and sometimes down slope form very shallow ecological sites. Indicator species: little bluestem, plains muhly, needle grasses and sideoats grama, with dotted gayfeather, pasqueflower and purple coneflower, and shrubs like broom snakeweed. This site has little bluestem, plains muhly, sideoats grama, more green needlegrass, less blue grama and needleandthread, similar production, different restrictive layer.]

(054XY033ND) – Thin Claypan (TCp)

[Well drained soils on uplands or terraces that don't receive extra moisture with a dense sodic subsoil above 6 inches and with salts above 16 inches restricting root penetration. Usually found in micro relief within Claypan sites, indicator species are western wheatgrass, Sandberg's bluegrass with an understory of blue grama and buffalograss, heath aster, cudweed sagewort and western yarrow along with a few shrubs of fringed sagewort, cactus and Nuttall's Saltbush. This site has a shallower sodic subsoils layer, less production, similar species, more blue grama, less needleandthread & green needlegrass.]

Inventory Data References

Information presented here has been derived from NRCS clipping and other inventory data. Also, field knowledge of range-trained personnel was used. All descriptions were peer reviewed and/or field tested by various private, State and Federal agency specialist. Those involved in developing this site description include: Dennis Froemke, NRCS Range Management Specialist; Jeff Printz, NRCS State Range Management Specialist; L. Michael Stirling, NRCS Range Management Specialist; Stan Boltz, NRCS Range Management Specialist; Josh Saunders, NRCS Range Management Specialist; Darrell Vanderbusch, NRCS Resource Soil Scientist; Michael D. Brand, State Land Dept. Director Surface Management; David Dewald, NRCS State Biologist; and Brad Podoll, NRCS Biologist.

<u>Data Source</u>	<u>Number of Records</u>	<u>Sample Period</u>	<u>State</u>	<u>County</u>
SCS-RANGE-417	5	1971 – 1976	SD	Perkins
ND-CONS-20	1	2001	ND	Dunn

State Correlation

This site has been correlated with Montana and South Dakota in MLRA 54.

Field Offices

Baker, MT	Bowman, ND	Dickinson, ND	Killdeer, ND	Selfridge, ND
Beach, ND	Buffalo, SD	Dupree, SD	Mandan, ND	Sidney, MT
Beulah, ND	Carson, ND	Faith, SD	McIntosh, SD	Watford City, ND
Bison, SD	Culbertson, MT	Hettinger, ND	Mott, ND	Wibaux, MT

Relationship to Other Established Classifications

Level IV Eco-regions of the Conterminous United States: 43a – Missouri Plateau.

Other References

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (<http://hpccsun.unl.edu>)

USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (<http://wcc.nrcs.usda.gov>)

USDA, NRCS. National Range and Pasture Handbook, September 1997

USDA, NRCS. National Soil Information System, Information Technology Center, 2150 Centre Avenue, Building A, Fort Collins, CO 80526. (<http://nasis.nrcs.usda.gov>)

USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

USDA, NRCS, Various Published Soil Surveys.

Site Description Approval

State Range Management Specialist

Date

State Range Management Specialist

Date

State Range Management Specialist

Date